1. *Course number and name*
   ENGR 304: Mechanics of Fluids

2. *Credits and contact hours*
   3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. *Instructor's or course coordinator's name*
   Instructor: Paul Tan, Instructor
   Course coordinator: Elahe Enssani, Associate Professor of Mechanical Engineering

4. *Text book, title, author, and year*
   D. F. Elger, B. A. LeBret, C. T. Crowe, and J. A. Roberson. *Engineering Fluid Mechanics,* 11th ed., John Wiley & Sons, Inc., 2016.
   a. *other supplemental materials*
   (none)

5. *Specific course information*
   a. *brief description of the content of the course (catalog description)*
   Statics and dynamics of incompressible fluids, dimensional analysis, and similitude; fluid friction; laminar and turbulent flow in pipes; forces on submerged structures; fluid measurements.

   b. *prerequisites or co-requisites*
   PHYS 240: General Physics with Calculus III (Wave motion, optics, and thermodynamics); ENGR 201: Dynamics.

   c. *indicate whether a required, elective, or selected elective course in the program*
   Required for Civil Engineering; required for Mechanical Engineering.

6. *Specific goals for the course*
   a. *specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.*
   - Students will demonstrate that they understand the definition of a fluid and are familiar with properties that describe fluids.
   - Students will demonstrate that they can evaluate pressure variation in a hydrostatic fluid.
   - Students will demonstrate that they can evaluate hydrostatic forces on plane and curved surfaces.
   - Students will demonstrate that they can evaluate buoyancy forces on immersed and floating bodies.
   - Students will demonstrate that they can apply the continuity and Bernoulli equations to fluid systems.
   - Students will demonstrate that they can apply the momentum equation to fluid systems.
   - Students will demonstrate that they can apply the energy equation to fluid systems. Students will demonstrate that they can interpret hydraulic and energy grade lines.
   - Students will demonstrate that they can identify dimensionless parameters using the Buckingham Pi theorem and dimensional analysis.

- Students will demonstrate that they can use the methods of similitude to specify the requirements for scale model tests.
- Students will demonstrate that they can analyze problems involving boundary layer theory and surface resistance.
- Students will demonstrate that they can analyze problems of laminar and turbulent flow in conduits.
- Students will demonstrate that they can analyze piping systems considering pipe friction and loss coefficients.
- Students will demonstrate that they understand the concepts of drag and lift, and are able to use drag and lift coefficients.
- Students will demonstrate that they can apply selected principles to the design of engineering systems.
- Students will demonstrate that they are familiar with common spreadsheet programs.
- Students will demonstrate that they can write a coherent technical report describing their analysis of and solution to an engineering design problem.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, c, d, e, g, h, j, k.

7. Brief list of topics to be covered

- Introduction to fluids and fluid properties
- Hydrostatic pressure variation
- Pressure measurements
- Hydrostatic forces on plane and curved surfaces
- Buoyancy and stability of immersed and floating bodies
- Flow visualization
- Fluid velocity, Lagrangian and Eulerian viewpoints
- Basic control volume analysis
- Continuity equation (conservation of mass)
- Rotation and vorticity
- Pressure variation in a flowing fluid
- Bernoulli equation
- Momentum equation
- Energy equation
- Hydraulic and energy grade lines
- Dimensional analysis and similitude
- Boundary layer theory and surface resistance
- Flow in pipes and conduits
- Drag and lift